A device for fixation of a portable drilling or milling machine on a template for making holes in a workpiece, and an orbital machining apparatus for producing such holes

Background of the invention

1. Field of the invention

The invention relates to a device for providing an improved temporary fixation of a drilling or milling machine on a template for making holes and/or recesses at predetermined locations in a workpiece. In particular, but not exclusively, the device of the present invention is adapted to temporarily fixate a portable orbital drilling machine to a template which is mounted onto a workpiece in which holes are to be formed at locations determined by pre-formed apertures in the template.

2. Description of related art

WO 94/17944 and WO 01/15870 disclose earlier embodiments of devices for fixation of a portable hand tool apparatus to a template for producing holes in a workpiece. These devices comprise a sleeve, which is attached to the template aperture by means of screw joints. This requires threaded holes to be formed in the template and separate screws therefor.

Summary of the invention

An object of the present invention is to eliminate the need of screw joints when temporarily fixating a hand tool apparatus in an aperture of the template and to provide a fixation device, which facilitates and improves the attachment of the hand tool apparatus to the template.

To this end the device of the present invention for temporary fixation of a portable cutting machine to a template for making holes and/or recesses in a workpiece, comprises:

a guide sleeve having a tubular hub with an outer diameter corresponding to an inner [illegible] of an aperture in the template, a forward end of the hub having radially [illegible]ng lugs configured and located so as to match corresponding recesses in the [illegible]ve during insertion of the guide sleeve therein and to obtain a locking [illegible]ment with an inner surface of the template after a partial rotation of the guide [illegible]lative to the template, and a rearward end of the hub being connected to a [illegible] adapter socket to be mounted to a nose portion of the cutting machine; and

a [illegible]ioning unit mounted to the adapter socket for axial displacement relative thereto and having a forward end surface for engagement with an outer surface of the template.

Further features and details of the present invention are set forth in the following claims and will be disclosed in the following detailed description with reference to the accompanying drawings.

Brief description of the drawings

Fig. 1 is a longitudinal sectional view of a portable hand tool apparatus attached to a template for making holes in a workpiece;

Fig. 2 is a plan view of a backside of a template having two types of apertures for receiving a guide sleeve of a fixation device of the present invention;

Fig. 3 is a cross-section of the template taken along the line 3-3 in Fig. 2;

Fig. 4 is a longitudinal cross-sectional view of the fixation device of the present invention;

Fig. 5 is a perspective view of the guide sleeve of the fixation device;

Fig. 6 is a perspective view of a hand tool apparatus to be attached to a template;

Fig. 7 is a perspective view of a hand tool apparatus attached to a template; and

Fig. 8 and 9 is a side view and a plan view, respectively, of a fixation device of the present invention attached to a curved template.

Detailed description of a preferred embodiment

Fig. 1 illustrates a portable hand tool machine 10 for orbital drilling of holes or recesses in a workpiece 14. For temporarily fixating the machine 10 to a template 12 having apertures 16 located at spots where holes are to be formed in the workpiece a fixation device 5 of the present invention is used.

As shown to the left in Fig. 2, each aperture 16 in the template 12 may have a circular configuration with at least one, but preferably a plurality of, for example four, axial recesses or grooves 18 at the periphery of the aperture for receiving a guide sleeve 20 (Fig. 4) of the fixation device 5, which is mounted to the front end of the drilling machine 10. A recess 22 (Fig. 3) adjoins the aperture 16 on the template backside facing the workpiece for receiving correspondingly profiled protrusions or lugs 24 (Fig. 4 and 5) on the guide sleeve 20 without engaging the surface of the workpiece. Alternatively, each profiled aperture in the template 12 may be formed in a detachable insert 26 secured by threads to the template, as shown to the right in Fig. 2 and 3. The template 12 may be made of any suitable metal, plastic or composite material and can be made flat or curved in one or more directions.

As shown in Fig. 1, 4 and 5, the guide sleeve 20 of the fixation device 5 has a tubular hub 30 with an outer diameter corresponding accurately to the inner diameter of the aperture 16. The forward end of the hub 30 has four protrusions or lugs 24 configured

and located to match the grooves 18, and at the rearward end of the hub 30 there is a base plate 32 to which is mounted an adapter or fixture socket 34 by means of screws 36. The socket 34 is mounted to a nose portion 38 of the drilling machine 10. A tension ring 40 having three turning wings 42 is threaded onto the outer periphery of the socket 34 and engages a pressure plate 46, which is configured to rest against the outer surface of the template 12 and is axially and rotatably supported relative to the tension ring 40 by means of a bearing 48. In case of a template having a curved outer surface, such as a spherically curved surface, the pressure plate 46 may comprise three or more pressure elements (not shown) which are individually articulated by ball joints so as to be automatically adjustable to the inclination of the surface of the template.

Fig. 6 is a perspective view of a portable orbital drilling machine 10 to which is attached a fixation device 5 of the present invention, and Fig. 7 shows the machine 10 mounted to a template 12. When mounting the machine 10 (or the fixation device 5 separately) to the template 12 for making an accurate hole in the workpiece, the guide sleeve 20 of the fixation device 5 is axially inserted through the aperture 16 and then turned 45° so that the lugs 24 will come into a locking engagement with the backside of the template 12. In order to obtain a stable and accurate fixation of the machine 10 to the template 12 the tension ring 40 is turned with help of the wings 42 such that the socket 34 will be axially displaced (rearwardly), thereby bringing the lugs 24 of the guide sleeve 20 to axially tighten the template 12 against the pressure plate 46 on the other side thereof. Alternatively, instead of using wings to achieve the axial tightening, a pneumatic assembly can be used.

Fig. 8 and 9 further illustrate, in a side view and a plan view, respectively, a curved template 12 having a plurality of apertures 16 for the fixation of a drilling machine (not shown) by means of a fixation device 5, perpendicular to the surface of the template 12.

Fig. 1 further discloses an arrangement of a mechanism for adjusting the radial offset of the longitudinal axis of the cutting tool 50 of the orbital drilling machine 10. The

machine 10 comprises a spindle motor 52 for rotating a spindle unit 54, holding the tool 50 at its forward end, about its own center axis via a gear mechanism 56, a radial offset adjustment mechanism (to be described later), an eccentric rotation mechanism 58 for orbiting the cutting tool 50 about a principal axis (corresponding to the center axis of the hole to be formed) and an axial feed mechanism 60 (Figs. 6 and 7).

The radial offset mechanism comprises an inner hollow cylindrical body 62 rotatably supporting the spindle unit 54 therein. The spindle unit 54 is rotatably supported in an eccentric cylindrical hole in the inner cylindrical body 62. The eccentric hole has a longitudinal center axis that is parallel to but radially offset a distance from the longitudinal center axis of the inner cylindrical body 62. The eccentric inner cylindrical body 62 is, in its turn, rotatably supported within an axially extending eccentric hole of a second, outer hollow cylindrical body 64. The eccentric hole has a longitudinal center axis that is parallel to but radially offset a distance from the center axis of the cylindrical body 62 (the principal axis). Preferably, the holes of the cylindrical bodies 62 and 64 have the same eccentricity, i.e. the hole center axes are radially offset the same distance from the respective center axis and of the bodies 62 and 64. By rotating the inner cylindrical body 62 within the eccentric hole of the outer cylindrical body 64, or by a mutual, relative rotation of the cylindrical bodies 62 and 64, it is thus possible to locate the center axis of the eccentric hole of the inner cylindrical body 62 such that it, and hence the spindle unit 54 and the center axis of the cutting tool 50, will coincide with the center axis of the outer cylindrical body 64. By performing a mutual, relative rotation of 180° of the inner and outer cylindrical bodies 62 and 64 away from this zero radial offset position, a maximum offset of the cutting tool axis is obtained.

In order to adjust the mutual rotational position of the inner and outer cylinders 62, 64 to thereby adjust the radial offset of the axis of the spindle unit 54 an adjustment unit is provided at the rear end portion of the inner cylinder 62 so as to be located far away from the tool working area, where dust and chips are generated, which may affect the function of the adjustment unit, and where easy access is allowed to the mechanism.

For example, the adjustment unit may have the form of a worm gear mechanism which includes a worm screw (not shown) that is rotatably supported in a block 66 and engagable with a worm wheel (not shown) fitted to the inner cylindrical body 62. A scale 68 indicating the eccentricity of the tool 50, i.e. the diameter value exceeding the fixed diameter of the tool 50 and which generates the finished diameter of the hole to be formed, is located adjacent and rearwardly of the block 66.

The drilling machine 10 further includes an improved mechanism for locking the inner and outer cylindrical bodies 62, 64 together after setting the desired eccentricity thereof. The locking mechanism comprises an axially displaceable nut 70 which engages the block 66 such that a tapered section 72 of the front portion of the inner cylindrical body 62 will be tightened against a matching tapered surface 74 of the front portion of the outer cylindrical body 64. In this manner a stabilized mutual locking of the bodies 62, 64 will be obtained at a short distance from the tool 50.

As best shown in Figs. 6 and 7, the axial feed mechanism 60 may comprise a pair of telescoping linear guide members 76, 78 on opposite sides of the outer housing 80 of the drilling machine 10. The drilling machine 10 may be displaced axially by help of a handle 82 and the guide members 76, 78, or by a pneumatic drive assembly (not shown).

The orbital motion of the tool 50 is carried out by a motor 84 which rotates the outer cylindrical body 64 via a belt transmission 86. An outlet pipe 88 for removing working dust and chips is connectable to a vacuum source.